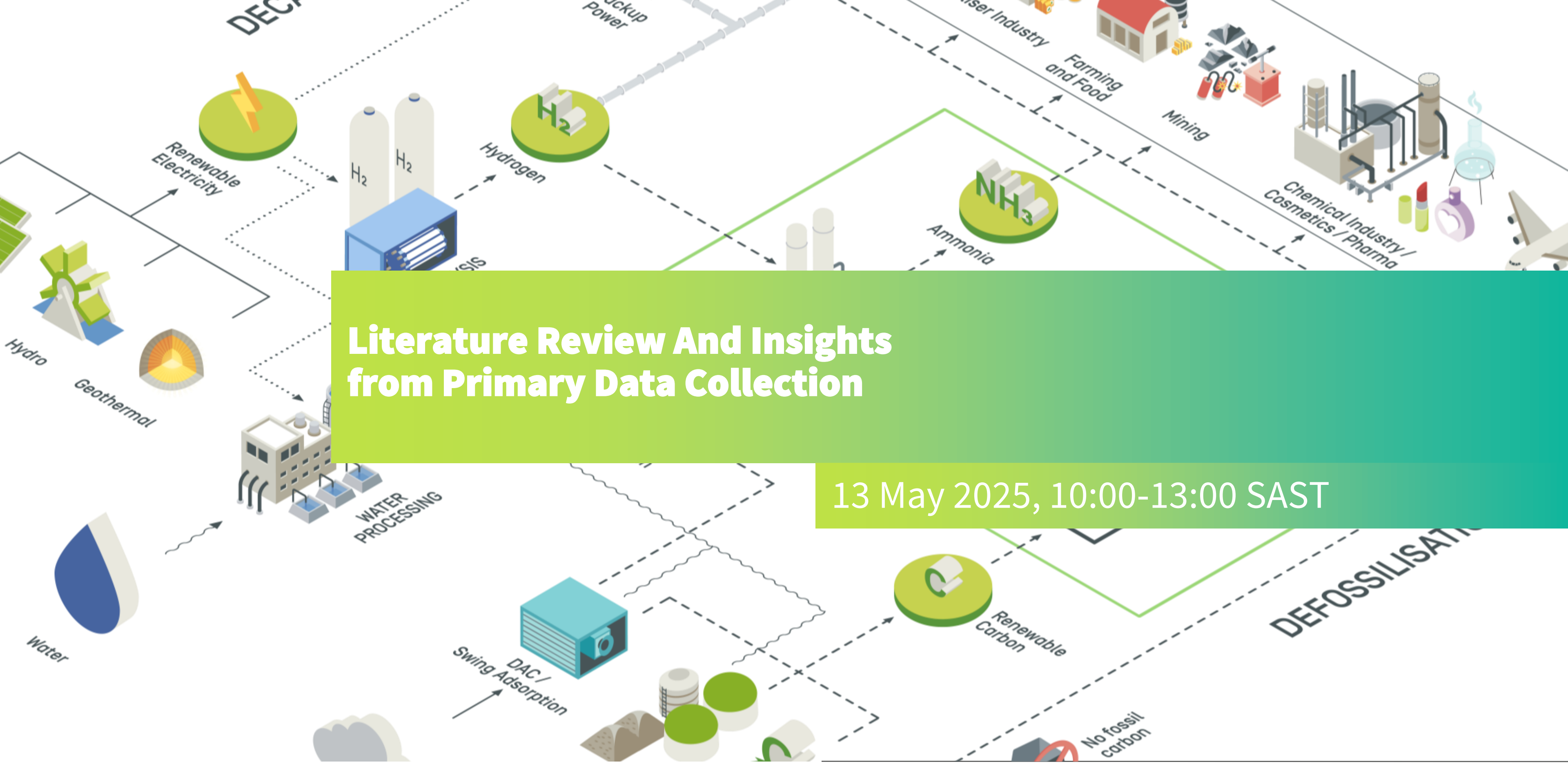

Literature Review And Insights from Primary Data Collection

13 May 2025, 10:00-13:00 SAST

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The study explored five main themes

Production:	Cost-effectiveness of switching, financing for CAPEX, willingness to shift, existing incentives, and producer demand.
Consumption & Uses:	Consumer demand, pricing, current distribution infrastructure, and farmer acceptance of liquid/green ammonia.
Opportunities:	Viability for low-carbon tech adoption (carbon markets), import substitution benefits, and regional export potential.
Risks & Barriers:	Ammonia storage adequacy, practical distribution (especially to smallholders), cost-competitiveness, and de-risking programs.
Socio-economic Impacts:	Potential for new production chains, upskilled/new jobs, and impact on farmers (income, jobs, water usage).

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Study Objectives

What We Aimed to Achieve	To conduct a comprehensive analysis of existing knowledge and evidence, supported by primary data, in South Africa and the SADC region.
	To identify the co-benefits of green ammonia and green fertilizer, including sustainability, environmental, and socio-economic advantages.

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Methodology - Our Approach

Data Collection:	Primary data gathered in Limpopo, Mpumalanga, and Free State provinces.
Sampling:	Combined purposive and snowball sampling techniques were used.
Tool:	A semi-structured questionnaire was administered covering the five themes of the study (Production, Consumption & Uses, Opportunities, Risks & barriers, and Socio-Economic Impacts)
Focus Areas:	Data collection followed the main fertilizer use belts, targeting crops like citrus, maize, potatoes, sugarcane, and sunflower.
Interviewees:	Interviews were conducted with various fertilizer value chain players, including blenders, agro-dealers, farmers, and associations (e.g., FERTASA, ARC). **[Blenders = 18; Hubs=3; Farmers =3 & Stakeholders=2]**

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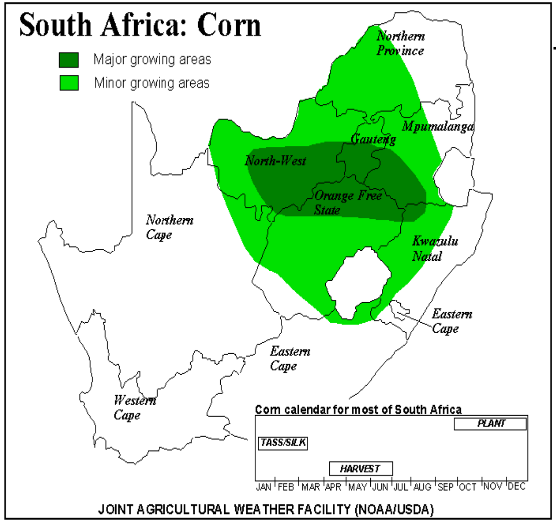
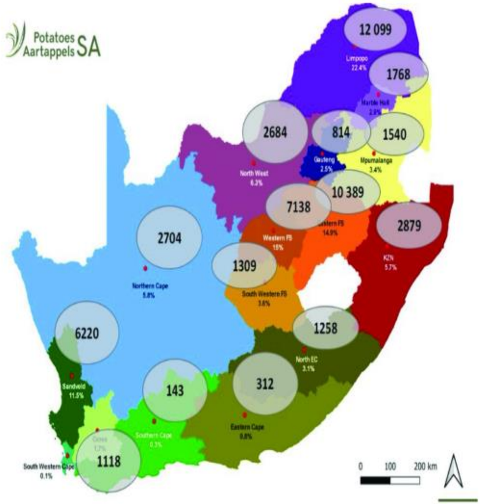
Justification of Study Area

Supply Side:	Demand Side - Key Stakeholders Engaged:
❑ **Engaged fertilizer blenders and manufacturers** • Strategically located in high-demand regions, Mpumalanga, Free State, and Limpopo.	❑ **Targeted the main users of fertilizers in the country** • Maize growers in the Mpumalanga-Orange Free State belt. • Potato growers in the Potato Belt (Limpopo and Orange Free State). • Subtropical fruit farmers in Limpopo. • Irrigated sugarcane farmers in Malelane, Mpumalanga.





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Production: Profiles of Fertilizer Blenders Interviewed

Status:	Key Blenders Profiled (Examples):	General Observation:
No e-fertilizers (green ammonia-based) are currently available in the market	• **Omnia (Groblersdal, Delmas, Danielrus):** Produces granular & liquid fertilizers; serves citrus, maize, beans, sunflower farmers; some direct ammonia application. • **TRIFERT (Marble Hall, Letsitele):** Produces liquid NPK specialty blends for citrus. • **AFRIFERT (Marble Hall):** New granulation blender (43,000MT/year); plans for liquid fertilizers. • **Origin Agrisciences (Groblersdal):** Produces liquid specialty fertilizers (10M litres/year) for citrus. • **Impala Kunsmins (Malelane):** Ammonia blender for sugarcane. • **ProGas (Vrede):** Distributes grey ammonia to commercial corn and citrus farmers. • **VS Agri (Vrede):** Distributes aqueous ammonia, liquid fertilizers, and produces liquid ammonium phosphate.	Blenders are often located near key agricultural production zones. 

Production: Prospects of Switching to Green Ammonia

Current Grey Ammonia:	South Africa has advanced grey ammonia production (SASOL, Omnia), but demand (especially in sugarcane, maize, soybeans) outstrips local supply, necessitating imports.
Existing Use:	Irrigated sugarcane (Malelane) and maize (Free State) already use grey ammonia directly, indicating a potential pathway for e-fertiliser adoption.
Infrastructure Base:	Companies like VS Agri Group and Omnia Group have existing investments in ammonia storage, transportation, and application equipment.
Decentralization Trend:	Blender locations are consistent with decentralizing operations, bringing production closer to end-users.
Key Risks for Green Ammonia Adoption:	• **High Capital Expenditure (CAPEX):** Initial investment for production facilities and infrastructure. • **Market Availability & Acceptance:** Farmer hesitancy without assurance of effectiveness and reliability; potential higher price for green fertilizers. • **Raw Material Consistency:** Availability of inputs for green fertilizer production, especially as some planned green ammonia (e.g., Hive Hydrogen SA) is earmarked for export.

Production: Additional Capital Costs for Green Ammonia Application

Investment Considerations for On-Farm Green Ammonia Use

- Beyond solar power and green ammonia production units, farmers/applicators would need specialized equipment for direct application:
    - Tractor (e.g., R500,000)
    - Injector assembly
    - Applicator tank (e.g., R300,000)
    - Nurse tanker
    - Hoses & valves
    - NH3 hose
    - Compressor
    - Ripper (e.g., R270,000)
    - NH3 spares






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Production: Financing Mechanisms

Global Level:	World Bank and IMF are potential funders for initial CAPEX for decentralized ammonia production, aligning with carbon footprint reduction mandates.
South Africa - National Level:	○ **Industrial Development Corporation (IDC):** Considering extending credit for green ammonia, but details and terms are still unclear as the sector is nascent. ○ **Land Bank's Agro Energy Fund (AEF):** ■ Launched in 2023 with R1.2 billion (partnership with DALRRD). ■ Blended finance (grant and debt) for alternative energy assets to reduce energy costs and impact of power interruptions. ■ Targets energy-intensive activities: irrigation, intensive production, on-farm cold chain. ■ **Grant Structure:** ■ Small Scale (Turnover R500k-R1m): 70% grant (cap R500k) ■ Medium Scale (Turnover R1m-R10m): 50% grant (cap R1m) ■ Large Scale (Turnover R10m-R50m): 30% grant (cap R1.5m)

Production: Financing Mechanisms

Willingness Factors:	Existing & Potential Incentives:
○ **Reduced Plastic Pollution:** Ammonia use does not involve plastic packaging, addressing a major environmental concern. ○ **Environmental Benefits:** Ammonia, under proper conditions, has lower leaching rates compared to other fertilizers, reducing water pollution. ○ **Research & Demonstration:** South Africa has advanced agricultural research institutions (public & private) and a strong culture of demonstration/field days, which can aid adoption.	○ **Fair-Trade Principles:** E-fertilizers, with environmental benefits, could align with Fair-Trade incentives, potentially earning premium prices (common in sugarcane). ○ **VAT Zero-Rating:** Currently applies to renewable energy components like solar panels. ○ **(Fertilizer) Plastic Levy:** If imposed on fertilizers, it could make e-fertilizers (which don't use plastic bags) more cost-competitive by reflecting the true cost of plastics. ○ **Agro-energy Fund:** (As detailed in Slide 10) provides financial support for energy-related investments.

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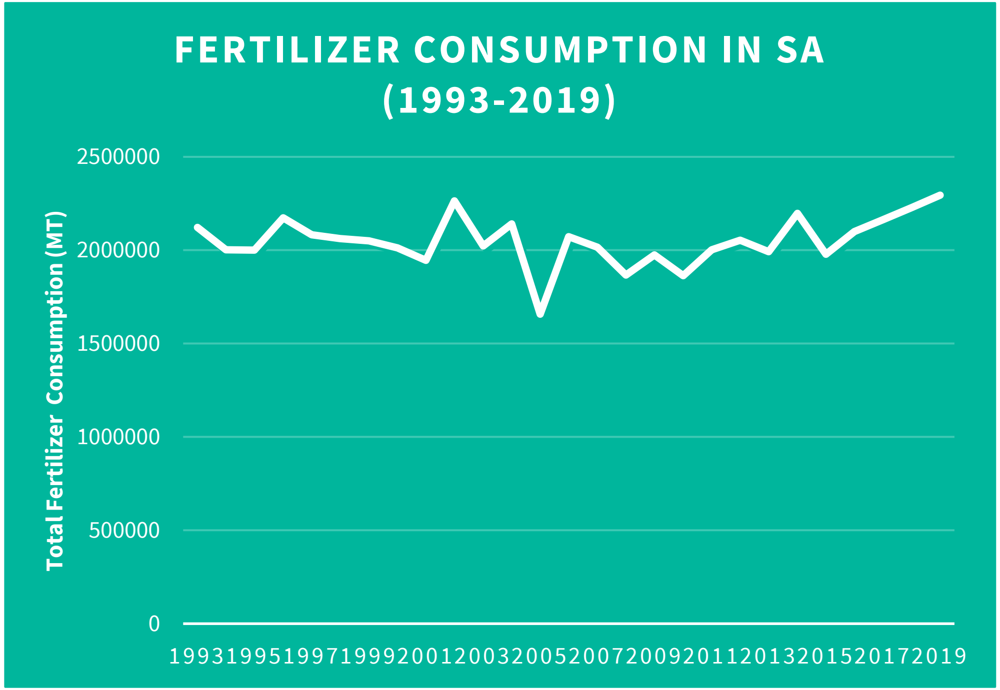
Consumption & Uses: Fertilizer in South Africa

Overall Consumption:	Annual fertilizer use has reached a plateau of approximately 2.3 million tonnes. Variations are often due to environmental factors like drought.
Nutrient Breakdown (Example - 2019):	○ Physical Tonnes: ~2.29 million ○ Nitrogen (N): ~470,000 tonnes ○ Phosphorus (P): ~104,000 tonnes ○ Potassium (K): ~115,000 tonnes
Top Consuming Crops (by Physical Tons):	1. **Maize:** 1,336,392 MT (56.51%) 2. **Sugarcane:** 268,501 MT (11.35%) 3. **Vegetables:** 107,412 MT (4.54%) 4. **Other Pastures:** 101,499 MT (4.29%) 5. **Wheat:** 92,735 MT (3.92%)



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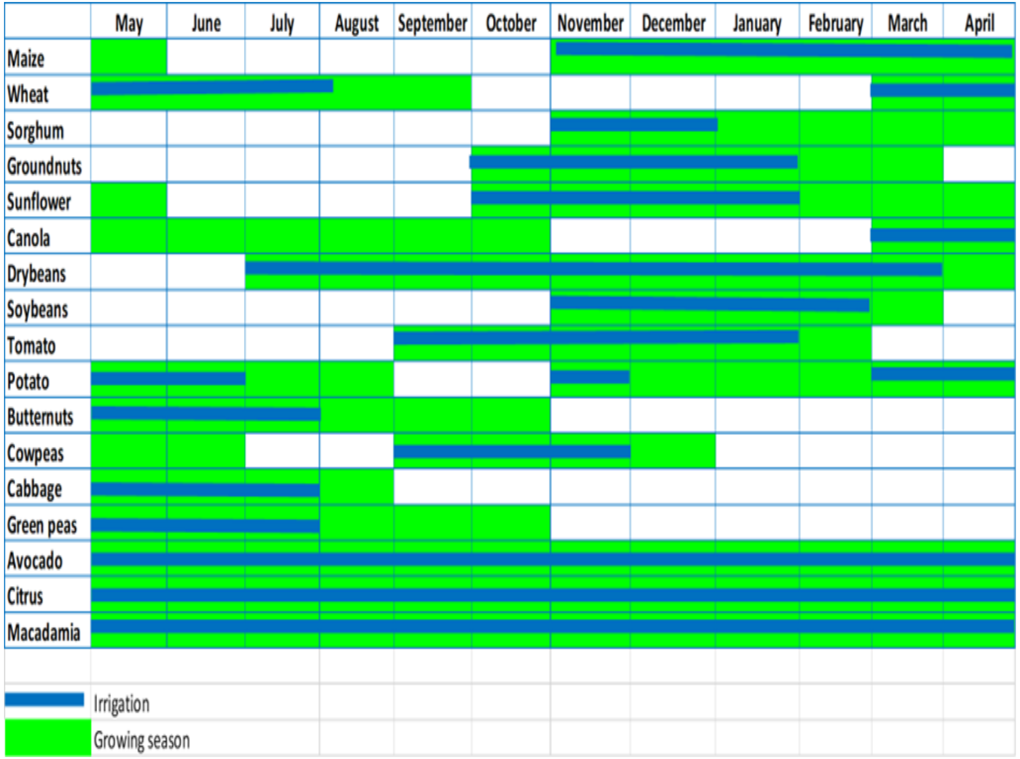
Consumption & Uses: Crop Calendar & Demand

- Fertilizer demand is inherently linked to crop production cycles:
    - **Horticulture (Macadamia, Citrus, Avocado):** Operations and fertilizer demand throughout the year.
    - **Potatoes:** Available intermittently; summer crop in Free State/parts of Mpumalanga (Nov-Apr), also grown in Limpopo.
    - **Cereals (excluding wheat):** Primarily summer crops.
    - **Sugarcane:** Fertilizer application typically from March/April to November/December, avoiding the main rainy season.



Consumption & Uses: Ammonia Distribution Infrastructure

- South Africa possesses well-advanced infrastructure for the transport and field application of (grey) ammonia:
    - **Bulk Transport:** Transnet tank cars (rail), mother tanks (large storage "bullets").
    - **Local Distribution:** Nurse tanks/wagons, road tankers of various sizes.
    - **Application Equipment:** Tractors, injectors, rippers for direct soil application, boom sprayers for liquid fertilizers.

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Consumption & Uses: Farmer Willingness to Adopt Green Ammonia/Liquid Fertilizers

- **High Acceptance of Liquid Fertilizers:** Already prevalent in South African agriculture.
- **Resilient Supply Chains:** Locally produced green fertilizers can reduce import dependence, stabilize supply, and potentially lower costs.
- **Factors Influencing Adoption:**
  - **Crop Type:** Tree crops are suitable. Potatoes, often using centre pivot irrigation, might face leaf burn issues with direct liquid application (drip is better).
  - **Irrigation System:** Farms with drip irrigation can easily adopt liquid fertilizers/fertigation.
  - **Proximity of Blenders:** Growth of blenders in high-value commodity areas improves accessibility for commercial and smallholder farmers.
  - **Early Adopters:** Farmers already investing in solar power are likely innovators.
  - **Existing Equipment:** Infrastructure for grey ammonia direct application can be adapted for green ammonia.

Smallholder Challenges: Safe use, application techniques, and distribution for liquid/aqueous ammonia need consideration, requiring collaborative efforts.

Opportunities for Green Ammonia & E-Fertilizer

- **1. Viable Nitrogen Delivery for Sustainable Agriculture:**
  - Suitable for long-lived horticultural crops (avocados, mangoes, macadamias) and key field crops (sugarcane, maize).
  - **Environmental Plus:** No plastics used in the ammonia value chain. Ammonia is the least leaching of all fertilizers, remaining stable in soil and reducing pollution.
- **2. Import Substitution Benefits:**
  - Local production offers price stability (a major attraction for traders like Obaro).
  - Enhances decentralization of fertilizer blending, improving accessibility for all farmers.
- **3. Regional Export Potential (SADC & Beyond):**
  - Huge potential to export green ammonia using existing "bullets" or specialized vessels.
  - Similar crop commodities (sugarcane, maize) grown in the SADC region already use grey ammonia.

Challenge: High transport costs for liquid fertilizers over long distances. Neighboring countries might also develop their own green ammonia facilities if they have similar horticultural crops and scale.

Risks and Barriers

- **Ammonia Storage:**
  - **Current Status:** South Africa has adequate storage facilities, including state-owned (Transnet) and private sector (ammonia producers, blenders like Impala Kunsmins with 50,000 tonnes for sugarcane). Some commercial farmers also have private storage.
  - **Manufacturing:** Capacity to manufacture ammonia "bullets" exists in Gauteng.
- **Distribution to Smallholder Farmers:**
  - **Infrastructure:** Well-developed network of trucks and tractors for last-mile delivery. Appropriately sized ammonia vessels are available.
  - **Challenge for Small Farms:** Aggregation of smallholder demand is crucial (nascent examples in KZN sugarcane).
  - **Rail:** Plays a critical role in bulk ammonia transportation.
- **Cost Comparison (Green vs. Grey Ammonia):**
  - **Current Reality:** Green ammonia is generally more expensive than grey ammonia.
  - **Grey Ammonia Pricing:** Cheaper during Northern Hemisphere summer. Practitioners state it's the cheapest N source per hectare; historically 75% of urea cost in sugarcane.
- **De-risking Programs:**
  - **Direct Programs:** No specific government/donor programs yet for de-risking green ammonia/e-fertiliser adoption.

Indirect Benefits: Can leverage broader agri-energy initiatives like VAT zero-rating for solar panels and the Agro-energy Fund.

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Socio-Economic Impacts

- **1. Creation of Green Jobs:**
  - Shift from grey to green ammonia opens new markets and creates employment across the value chain:
    - Manufacturing: Storage vessels, field application equipment.
    - Logistics & Transport: Drivers for various truck sizes (8 to 34 tonnes), tractor operators.
    - Services: Consulting agronomists, laboratory services.
  - High growth potential and labor-intensive crops (e.g., citrus, macadamias, avocados, sugarcane – see Table 3, p.37) are likely to adopt e-fertilizers, boosting incomes and employment in these sectors.
  - Even in less labor-intensive but food-security-critical crops like maize, improved access/affordability can boost efficiency and yields.
- **2. Sustainable Production of Commodities:**
  - Addresses plastic pollution as ammonia value chains do not use plastic packaging.
  - Potential for a plastic levy on conventional fertilizers could level the playing field.
- **3. Increased Yields and Food Security:**
  - Green ammonia, like grey, can increase crop yields (80% of global ammonia is for fertilizer).
  - Significant potential in SADC where application rates are below recommended levels.

Growth of blenders improves fertilizer accessibility for both commercial and smallholder farmers.

Key Observations & Reflections

- **Concentration of Blenders:** High intensity of fertilizer blenders observed in key horticultural production zones (e.g., Marblehall-Groblersdal with >5 blenders within 20km; Letsitiele).
- **Strategic Networks:** Well-established networks of blenders and agro-input suppliers along major agricultural corridors (e.g., N4 sugar/citrus belt, N11, maize belt towns like Delmas, Secunda, Standerton, Vrede). Average of one blender every 50km in some maize belt areas.
- **Cross-Border Potential:** Proximity of blenders near borders (e.g., Mpumalanga) offers opportunities to serve farmers in neighboring countries like **Mozambique & Eswatini**.
- **Key Ammonia Distributors Identified:**
  - Impala Kunsmins (Malelane, Mpumalanga - Sugarcane)
  - VS Agri (including ProGas) (Vrede, Eastern Free State - Maize, sunflowers, soybeans etc.)
- Omnia (Danielrus, Eastern Free State - Maize, sunflowers, soybeans etc.)

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Key Enablers for Green Ammonia Adoption

- **1. Policy & Incentives:**
  - **Plastic Levy:** Tweaking it for fertilizers to reflect true environmental costs could level the playing field.
  - **Carbon Dioxide Tax:** South Africa's existing Carbon Tax penalizes carbon-based activities.
  - **Climate Change Act 2024:** Provides an overarching framework for climate adaptation and mitigation.
- **2. Energy Transition Momentum:**
  - **High Renewable Energy Adoption:** Accelerated by load-shedding and government incentives (e.g., zero-rated VAT for solar PV). Strong manufacturing and high renewable potential.
  - **Just Energy Transition (JET) Program:** Aims to increase renewable energy use.
- **3. Leveraging Existing Strengths:**
  - **Other Agricultural Uses of Ammonia:** Fortifying maize silage, livestock sector applications.
  - **Advanced Research & Development:** Strong public (ARC, universities) and private sector agricultural research capabilities.
  - **Extension & Demonstration Culture:** Excellent culture of field days and demonstrations to improve awareness and willingness to adopt.
  - **Robust Institutional Architecture:**
    - **FERTASA (Fertilizer Association of Southern Africa):** Represents the industry, promotes integrity and member interests.
    - **Fertilizer Registrar (DALRRD):** Manages registration under Act 36 of 1947.
    - **Laboratories & Advisory Services:** Extensive network for analysis and agronomy support.

Conclusion / Next Steps (TBC)

- **Summary:** Green ammonia presents significant opportunities for South Africa in terms of sustainable agriculture, job creation, enhanced food security, and reduced import reliance.
- **Key Potential:** Leveraging existing infrastructure, strong agricultural research, renewable energy drive, and supportive policy frameworks can accelerate adoption.
- **Recommendations**
  - Increase awareness of green ammonia's potential in South Africa.
  - Facilitate field visits (e.g., by GIZ team) to current grey ammonia operations to build relationships.
  - Engage relevant Transnet stakeholders in discussions.